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ABSTRACT

Rapidly increasing capabilities and decreasing costs are making microcomputers ever more likely to find a significant role in education. Already valuable as management tools, the computers have shortcomings as instructional aids largely due to lack of adequate software. Rapidly increasing demand could provoke dramatic improvements in software in the near future. The Oakridge (Oregon) School District, a relatively small district, has been including computer instruction among its offerings at the middle and high school levels since the late 1960s. As a result of its experiences and the success of its students, the district is more committed to computers now than ever. During the two years from 1979 to 1981 the number of microcomputers used in schools in Oregon as a whole increased 800 percent and statewide organizations have developed several services to aid computer users in education throughout the state. (Author/PGD)

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Microcomputers in Schools: Promise and Practice

Bruce Kelsh and John Lindelow

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Vol. 25, No. 8

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Preface

Between 1979 and 1981 the number of microcomputers in Oregon schools increased by over 800 percent. In fall 1981 there were over 1,200 microcomputers in Oregon classrooms. Five hundred additional microcomputers were in the process of being purchased.

Educators in Oregon as elsewhere in the country are experiencing the microcomputer revolution. But just what this "revolution" will look like is subject to a lot of questions. Will the changes brought about by this new wave of technology transform education? What do the microcomputers offer that the older time-share systems cannot provide? Will the micros replace teachers?

This Bulletin represents a first step toward answering these and other questions that concern the impact of microcomputers on education. The Bulletin combines a review of what the national experts have to say about the latest computer technology with a close look at the actual use of microcomputers in Oakridge School District 76. To this is added a general survey of microcomputer usage in Oregon.

The Oregon School Study Council is indebted to the ERIC Clearinghouse on Educational Management at the University of Oregon for contributing the first chapter, "The Microcomputer Revolution and Its Impact on Education." The author of this chapter is John Lindelow, a research analyst and writer for the Clearinghouse.

Bruce Kelsh, OSSC graduate research assistant, wrote the chapters on Oakridge and Oregon.

Philip K. Piele
Executive Secretary

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Introduction

In the early 1700s, Thomas Newcomen developed the first commercially successful steam engine, which helped trigger a grand metamorphosis of Western society called the Industrial Revolution. In the late 1940s, the first electronic computers began performing basic mathematical operations in American and British science labs. These computers and their descendants, say numerous modern-day prophets, have helped unleash a societal transformation that will ultimately be no less profound than the Industrial Revolution and that will remold nearly every societal relationship and institution--including public education.

Despite the as yet unfathomed potential of computer technology, many seasoned educators are unmoved by the prophesies of the technologists. They have heard before the overblown claims that this or that technology--radio, film, TV, or programmed instruction--will "transform" public education. Moreover, since the early 1960s educators "have been listening patiently to the transistorized tales of future educational rapture spun out by computer buffs," as W. James Popham attests.

So will the revolution in education actually materialize this time? Or is it possible that public education will again escape unscathed from the ravages of the latest technological advance?

The present evidence--reviewed in the following pages--strongly suggests that the latest surge of the computer revolution will indeed have a forceful impact on public education in the 1980s. This is not to say that education will undergo the kind of radical "root-and-branch" revision that Arthur B. Shostak and others envision, or that schools will soon

cease to exist, as Alvin Toffler suggests. But the computer revolution will definitely have a significant impact on education in the next decade.

The following chapter describes the rapid development of computer technology and evaluates its impact on education. Chapters two and three illustrate this impact through the experience of one school district and the expansion of microcomputers in the state of Oregon.

The Microcomputer Revolution and Its Impact on Education

The still youthful computer revolution is currently in a rapid and forceful stage of development. The latest "great leap forward"--the introduction of the microcomputer in 1975--has greatly hastened society's entry into the "information age." The "micros" in particular promise to have a significant impact on education in the near future.

Shrinking Size, Expanding Performance

The extremely rapid development of the computer is often difficult to comprehend. For example, the central processing units of the latest computers are now so small that you can barely see them. Just twelve years ago, however, an equivalent processor would have filled a room.

The number of electronic components that can be placed on a silicon microprocessor chip has doubled each year since 1960, says Patricia Sturdivant, and the end is not in sight. In 1979, ten thousand words--the size of a daily newspaper--could be stored on a chip and any part accessed in one one-thousandth of a second or less.

This "Stone Age Technology," as Christopher Evans calls it, will be supplanted in the early 1980s, when a hundred thousand words--a longish novel--will fit on the same-sized chip; by the late 1980s, whole encyclopedias and more will fit on a square of silicon much smaller than a postage stamp. Recent developments in "bubble memory" promise even more mind-boggling compressions of information, so that memory capacity will probably cease to become a limiting factor for most applications before the end of the decade.

The "incredible shrinking computer" along with its incredible increasing capabilities led to the development and marketing of "microcomputers" in the late 1970s. Microcomputers are "stand alone" devices that are small enough to fit on a desk top and do not need to be connected to a larger computer to work. "The smallest microcomputers can easily perform most of the same instructions as the largest mainframes," says Sturdivant, the basic differences being the speed of execution and the memory capacity.

As with hand-held calculators--which plunged in cost from several hundred dollars to under ten in less than a decade--the cost of computers has fallen precipitously. A version of a computer that would have cost $25,000 a decade ago costs less than $1,000 now, says Sturdivant, and this includes a keyboard, cathode ray tube, floppy disc capability, and cassette player. Computer power that would have cost $100,000 prior to 1975 can now be purchased for $1,000.

In the short-term future, says Evans, computers will continue to become both cheaper and "quite dramatically smaller," while their reliabilities and memory capacities will dramatically increase. Price decreases will result from mass production of microprocessor chips, intense competition among microprocessor producers as the huge home and educational markets expand, and the decreased requirements for raw materials and energy supplies as the integrated circuits continue to shrink.

There is, however, an important limitation that will dampen the impact of computers on education. This is the development of quality instructional software or "courseware" as it is sometimes called, which currently lags far behind the capabilities of today's computer hardware. This point will be discussed more fully in the next section.

Impact on Education

The computer revolution has already begun to influence both the administration and classroom delivery of public education. These direct influences will continue to grow stronger in the coming decade, to the point where administrators and teachers may wonder how they ever got along without computers. Public education, however, will also be subject to some indirect effects of the computer revolution as personal computers continue their invasion of American homes.

Many school districts use computers for administrative tasks and classroom management. Computers are ideal for many tedious management functions and are getting so inexpensive and efficient that districts may soon find it too costly not to computerize. Although computers will continue to streamline district and classroom management, their influence on the heart of education--classroom instruction--will be slower to materialize.

Computer-aided instruction, or CAI, is not new to public education. In the 1960s, many optimistic observers predicted that the large mainframe computers of the day would revolutionize education. But size, cost, and lack of quality software ended these high hopes. In the late sixties, when minicomputers were developed, the same revolutionary rhetoric was expounded, yet the "minis" also failed to significantly change public education.

One system developed in the late sixties and early seventies has had some success. This is the PLATO system developed by Control Data Corporation and the University of Illinois. PLATO is a time-share system,

in which classroom terminals are connected to a large central computer; the system utilizes touch-sensitive screens with advanced graphics capabilities.

"A considerable amount of courseware has been developed for PLATO," Lou Frenzel reports, "and today it is probably the most successful CAI project in existence." PLATO is "quite efficient, some excellent courses are available, students learn using PLATO and, in general, express positive feelings about using it," says Gerald T. Gleason.

The main problem with PLATO is its costs, which are prohibitive for most school districts. "A single terminal in a local school district would cost in excess of $6,000," according to Gleason. Yet some educators and computer industry executives are confident that time-share systems will grow and prosper in the years to come, particularly if combined with microcomputers in flexible networks.

In 1975, microcomputers were introduced that had several advantages over time-share systems. Because they are self-contained, microcomputers do not depend on telecommunications connections with a mainframe, are not subject to the larger systems "downtime," are "less mysterious" to their users, and their usage is not restricted to odd hours.

When microcomputers were introduced, says Frenzel, "the same rhetoric about CAI being the ultimate teaching technique" was heard again. So is there any reason to believe that the prophets of the computer revolution might be right this time?

Declining Cost

The answer is yes, for two important reasons. The first is cost.

As noted earlier, microcomputers and their near-term descendants will make vast amounts of computer power available at relatively low cost, thus removing price as a deterrent to the widespread use of computers in schools.

This leaves the development of quality instructional software as the main impediment to the use of CAI in schools. There is good reason to believe, however, that the dramatic drop in cost of computer hardware will help solve this stubborn problem as well.

Writing good courseware, as Joseph M. Scandura notes, is a much more difficult, expensive, and time-consuming task than writing a successful text. It takes a special combination of knowledge and skills that is still difficult to find in any one person. The problem, then, boils down to one of funding for the expensive development of quality courseware.

The federal government was financing courseware development projects in the midsixties, according to Popham, but funding was ended when the projects "failed to secure quick and widespread educational improvement." Private industry also attempted to develop courseware in the 1960s, but could not turn a profit. Many large educational publishing firms, in fact, "lost their shirts" developing and trying to market courseware in the 1960s, according to Educational Technology magazine.

The difference today, says Evens, is the expanded size of the market for computer hardware and software caused, in turn, by the drop in cost of computers. The continuing development of small, inexpensive, and reliable microcomputers, he says, "will open up markets of staggering size, at first in Westernized societies and later in the Third World."

This will result in intense commercial exploitation of the most profitable markets. "And one of the biggest untapped markets in the world," says Evans, "is the application of computers to education." Already, says Educational Technology, some of the large educational publishing firms are moving back into the computer courseware field, while numerous smaller companies are also gaining footholds in the new market.

Increasing Intelligence

The second important reason why the "revolution" may materialize in the eighties is the continuing progress being made in the field of artificial intelligence. Despite the exaggerated claims and counterclaims of its proponents and detractors, artificial intelligence has been developing slowly but steadily over the past several decades.

Computer "intelligence" is a hotly debated semantic issue, but it is clear that computers already show some rudimentary abilities we would call reasoning or judgment if displayed by a human. In 1979, for example, a computer thoroughly trounced the world's backgammon champion. And, in chess, computers are now able to outperform the experts who program them.

In medicine, says Evans, "programs have already been written which take satisfactory histories in a large variety of common complaints, make simple recommendations for follow-up studies and even offer tentative diagnoses." Most patients, it turns out, prefer the computer to the doctor and are more truthful with it.

Most currently available instructional software is capable of only the more mechanical aspects of teaching, such as drill and practice or

testing. Some programs do adjust their presentations to difficult skill levels, many "interact" with the learner to some degree, and some allow the student to participate actively in simulations. The color graphics and audio effects of some machines help to increase attention span and enhance motivation. Thus, computers are already serving as valuable teaching aids, though they have not yet taken over a significant portion of the teacher's responsibilities.

By the late 1980s, computers may be able to take over some traditional teaching tasks, particularly the teaching of "rule-based" subject matter. The classroom teacher will manage students' interactions with the computers, provide traditional teaching in the "higher cognitive" and more complex subjects, and provide individualized instruction to students who need it.

Many parents--particularly upper- and middle-class parents-- will supplement their childrens' school lessons with computerized lessons at home. Courseware programs will be available with a variety of value systems integrated into them, so that parents will be able to inculcate their children with the moral code of their choice.

The Oakridge Experience

Students in Oakridge School District 76 have been studying and working with computers for a long time. Fred Board, math teacher in the district for nineteen years, began introducing his students to computers in the late 1960s. That's when the Lane County Educational Service District first joined the Oregon Total Information System (OTIS). In 1968 Oakridge had a terminal in the high school that connected to the OTIS mainframe computer by telephone.

"In the first or second year that OTIS was operational, I took a course at Lane Community College," relates Board. "Soon afterwards I began introducing computers to my seventh and eighth graders. It was a second math class--optional. I'd meet students over at the high school in the evenings." Early perseverance paid off for some of those students. Several of them have made computers their careers.

As early as the mid-1970s, before the microcomputer boom, Oakridge was attracting attention with its computer classes. In 1975 the district began to rent a terminal for instructional purposes in the middle school. In 1977 the district purchased two Ohio Scientific Instruments microcomputers for the high school. "People were coming from all over the state and looking," says Ken Carver, Oakridge's superintendent. "There just weren't many things being done then, especially in districts this size."

As microcomputer technology advanced and prices dropped, Oakridge upgraded its classroom computer capabilities. In the spring of 1980 the middle school disconnected from OTIS and purchased two Apple II

microcomputers. "With OTIS," Board recalls, "we had a teletype that was noisy and slow. There was room for only one student. It was frustrating for me and the students. OTIS had some extremely nice capabilities, but we never knew when we would have it. We had a lot of trouble with down time. I used to keep about three emergency lesson plans handy."

"We found out that by disconnecting OTIS for two years, we could buy our own computers with the money saved from the cost of renting equipment and telephone lines. The telephone charges were the biggest expense." The middle school also bought two disk drives and a line printer. It used televisions already on hand for the video display screens.

The Middle School

Exposure to computers begins at the middle school level in Oakridge. Fifth and sixth graders at Westridge Elementary get involved through computer games and the chess club. Seventh graders take a mandatory semester course in computers. Board, who also teaches math at Westridge, uses the Apples to teach seventh graders computer basics. "I probably spend half the time on computer literacy," he says, "the other half on programming. I think that the kids should know how to use machines. There are going to be a lot of them using computers eventually and they'll have to know how to operate them. If nothing else, this class gets a whole lot of kids over their fear of machines."

In the seventh grade, students learn to make use of the computer just as they have learned to use pocket calculators. They calculate math problems and use commercial software programs. Later they begin to write their own programs, most often games, and pull in other students to try them out during lunch hour and after school.

The High School

The high school builds on the interest and familiarity with computers that is created in the middle school. Eighth graders can sign up for a computer club during their activity time. Ninth through twelve graders have the opportunity to take a computer course every semester once they have taken some algebra and the high school's introductory computer course. High school classes emphasize programming.

Both Ralph Perigny and Keith Snuggerud, the math instructors who teach the computer classes, believe that algebra is necessary background for programming. As a result, algebra is a prerequisite for the first semester of computer science. Classes are small, a maximum of twelve students. With only two OSI micros, a bottleneck occurs if the class gets too large. Because high school courses center on programming, students need ready access to the computers in order to practice their skills. BASIC, Pascal, and other computer languages are taught.

In the introductory "rookie semester," two kinds of people emerge, says Snuggerud: those who can't get the computer to do anything and those who do really well and can get the computer to do what they want. Those who "get the bug" can go on to take as many semesters of

computers as they want.

As student skills increase, so does the complexity of programming assignments. "The idea is to give the advanced students something harder than they can handle. That way they stay interested and learn along the way," Snuggerud explains.

Typically the number of programs students work on decreases with their experience. In the second semester, a student may write ten to twelve small programs. In the second year, a good student will write only four or five programs in a semester. An advanced student might work on only one or two. Each task becomes more complex and elaborate than the previous one. One of the goals at Oakridge is to eventually have a portable computer that could be taken from classroom to classroom in the elementary grades. In addition to exposing elementary students to the computer, it would provide challenging work for the high school students to write new programs requested by the elementary teachers.

"Programming causes you to work with concepts and the processes that are involved in problem-solving," says Snuggerud. "You discover aspects to the problem that you never knew existed. For example, a program we used at basketball games shut down when one team didn't score the first quarter. We hadn't included the possibility of a scoreless first quarter when we wrote the program."

Students who get keen on computers can learn more than their instructor. "It's great," says Snuggerud, "they'll keep on growing. I simply don't have the time to keep up with them." Students have more

time than their teachers to spend with the computer. "If I let them, I would have kids on the computer before school, after school, and during lunch," Snuggerud admits. "If I come in on a weekend and someone sees my rig out front, I'll have a computer student pounding on my window. I can never get on the computer. I have to catch up during the summer."

A certain kind of student is attracted to computers. After all, becoming a computer wizard takes a lot of time. The computer offers a special opportunity to students who may not be successful in other areas, Snuggerud feels. Those who play "mind games" more than outdoor games are drawn to the computer. Although classes are divided fairly evenly between males and females, in Snuggerud's estimation the zealous computer enthusiasts tend to be male, quiet, often shy, and not very active socially or athletically.

The high school program exposes a large part of its student population to computers. In its 1981 graduating class of approximately 70, about 40 had some computer experience. Oakridge graduates have gone on to study computer science at Willamette Community College, Lane Community College, and the University of Oregon. Some have demonstrated such outstanding abilities that they have been hired by computer science departments to assist first-year students. Oakridge's program is unusual for a small district because of the opportunity it offers its students to learn programming.

Personnel

Oakridge has had a longer than average successful relationship with

computers and has faced the same three problems that all districts encounter when they contemplate entering the computer age. First is qualified personnel. A district must have at least one person who is interested in computers and willing to learn more. Oakridge's early entry into computer education would not have occurred when it did if it hadn't been for teachers who were personally interested in computers and eager to share their knowledge with their students. Fred Board went on to earn a masters degree in computer science from the University of Oregon in the mid-1970s. Keith Snuggerud accumulated large quantities of graduate hours in computer science and has taught computer classes at the college level. Both men have left their mark.

"Keith and Fred have done an outstanding job for us," declares Superintendent Carver. "I think we've got two of the best in the state. Ralph Perigny has been taking courses in the summer and has been doing a fine job too. We've got three we can call on right now, which is rare in a district this size."

Hardware

The second problem is computer hardware--what to buy and when to buy it. The high school bought Ohio Scientific Instruments microcomputers. The middle school bought Apple IIs, and Board has been very happy with them.

"The reason we selected Apple was that people we checked with were having good luck with them," explains Board. "We really liked the graphic capabilities. The kids get instant success. They all get that first program, and it works. It's all very visual and they can see

what's happening. It did what we wanted it to do, and it was what we liked, so we went with Apple."

The high school still owns the two OSI micros purchased in 1977 before Apple was on the market. "At the time it had what I wanted," said Snuggerud. "I didn't know if I should wait six months to see if something better would come out or not, but a friend told me that it's always going to be like that. No matter when you buy--six months later something better will come out. If OSI does what you want and you want to work with micros, go with that." Snuggerud took his friend's advice and the computer program in the high school was launched.

Snuggerud has been happy with OSI but now he would recommend buying Apple, a disk drive to accompany it, and a lineprinter. Using disk rather than cassette tape is critical, he believes. "With a disk the Apple is sturdy and durable enough for kids to use. Being able to save hard copy of programs is very useful and a line printer is a very handy addition to the unit."

The middle school has a lineprinter in the classroom, but the high school doesn't own one yet. It's next on the list, and when funds are available it will become a reality. In spite of budget difficulties, Oakridge stands firm in its commitment. "Computers will <u>not</u> be cut here," says Carver firmly. "To us it's just as important as math or science. We can't purchase the lineprinter this go round, but it's in line and we're planning to eventually do it." For those same budget reasons it's unlikely Oakridge will be purchasing more micros in the immediate future.

Software

Finding software is perhaps the final hurdle to introducing microcomputers into a school. Only with the right software can teachers get computers to do what they want, and the search for software is not easy. The myriad of computer products on the market makes selection laborious.

Good software is expensive and is difficult to evaluate. Companies who write software have a problem. Software is easy to copy. Consequently, says Board, "It is very difficult to look at software ahead of time to see if it's what you want. It's very time consuming to really check out software. We've purchased five or six pieces of software and out of that I have three programs I feel are very usable."

Good software should be almost automatic. The instructions to the student should be clear and simple. The instructor shouldn't have to show each student the little tricks of each program. That's time consuming and defeats the purpose of having a micro in the classroom.

According to Board, much of the software on the market has poor documentation. Unless the instructor already knows a great deal about computers, a lot of time may have to be spent finding out how the program is supposed to work. Snuggerud ranks Apple high in this category. "Apple documentation is tremendous," he says. "It's written in clear everyday English. People with no background can sit down and work their way through the material." Both Snuggerud and Board agree that, generally speaking, software for schools is still not up to standard.

The Rapid Expansion of Microcomputers in Oregon

The typical entry point for microcomputers in schools is the math departments. But microcomputers can also be used in social studies, language arts, and extracurricular activities like the chess club. Some schools use microcomputers in art classes for graphic design and in special education to help the handicapped. The possible uses of microcomputers for instruction keep expanding and more and more schools become interested.

In fall 1981, Jim Sanner, instructional technology specialist at the Oregon State Department of Education, completed a survey of microcomputer usage in Oregon schools. This survey was similar to one conducted in 1979. In this two-year period the number of microcomputers used for instruction increased by over 800 percent.

In 1979 there were about 150 units in Oregon classrooms. By fall 1981 there were 1,234. There 447 Apples, 407 Pets, 305 TRS 80s, and 75 other micros. Of the 1,100 school buildings in Oregon, 590 have instructional micros. More will be purchased.

The survey indicates the trend is going to continue. Two hundred fifty-two schools are planning to buy Apples, 112 to buy Pets, and 90 to buy TRS 80s; 50 schools plan to buy a micro but haven't decided which unit to purchase. Sanner also reports that this year he has received hundreds of phone calls from districts wanting information about how to find the microcomputer that best suits their needs.

Ben Jones, manager of instructional services for the Oregon Total Information Service, notes that since the advent of micros about four years ago there has been a steady decline in the number of instructional hours

used on OTIS's time share computers. (Microcomputer usage hasn't had much of an impact on the number of subscribers who use OTIS for administrative purposes.) Schools have been purchasing micros with the funds they were using for terminal and line rental. The areas in Oregon with the greatest population density seem to have been the ones quickest to buy micros.

Although 90 to 95 percent of OTIS's revenue is derived from information management, the remainder comes from its instructional programs. Jones would like to see the instructional component of OTIS continue because of the quality of some of its programs. "However, if the time comes," he admits, "that people can provide instruction more economically or more feasibly on microcomputers, they ought to do that. Just because we do it, doesn't mean that it's the only way that it can be done." Schools interested in exploring possible investment in micros for instruction have several sources of information available to them.

Computer Consortium

Oregon schools are sharing resources as well as information in their search to get the most for their computer dollars. Good software is expensive and difficult to select. Usually it can't be copied without breaking copyright laws, but an interesting approach to legally sharing software is being used in Oregon these days.

Little state money was available in fall 1981 for instructional computing. As a result, the instructional technology division of the State Department of Education helped establish a consortium of school districts.

Each district contributed fifty to one hundred dollars depending on its size. With that money the districts collectively were able to bring over one thousand programs into the state to be distributed among consortium members. All the programs were copyright free or had very liberal copyright policies. For example, the consortium contracted with the state of Minnesota for all its instructional programs. Part of the agreement with Minnesota allows districts to make as many copies of programs as they need to do their work. James Sanner of the instructional technology division can provide districts with more information about Oregon's computer consortium.

Predictions

Will microcomputers revolutionize the nature of public education in Oregon? In spite of ambitious claims for the micro, Snuggerud doesn't see it as radically changing the structure of schools:

> It won't be replacing teachers, especially in the elementary school where a one-to-one, teacher-to-student relationship is so important. At the most, computer instruction could be half of a high school student's day. It could effectively be used to teach classes with few students, for example--those that are expensive for a school district to run. I see computers as remaining elective courses in the math area and supplementing others.

Carver agrees. "I think we're going to see a lot of packaged instruction. There will be computerized instruction that will refine training and talent, but the teaching of concepts, and the interaction that has to be there, will be there with a teacher."

Major publishers are plowing lots of money into software development. They are aiming mainly at elementary schools and basic skills areas, their

biggest markets. Nevertheless, Don Holznagel of the Northwest Regional Educational Laboratory does not see any software that will bear the burden of teaching concepts. The assumption that accompanies present software is that teachers have handled concepts and there will be heavy teacher involvement in making assignments, directing students on the computer, and tracking their progress.

As for the next five to ten years? "People are looking too soon at the possibility of replacing teachers with computers," says Holznagel.

> The kind of material that is available and is likely to become available in the near future is not completely tutorial in nature. It will not be able to replace all teacher functions. It's all supplemental. The bulk of material available at elementary level in basic skills replaces only certain teacher functions like drill and practice activities.

Sanner holds much the same opinion:

> I think that the microcomputer is not going to replace teachers--not good teachers, that can't be done. It will allow teachers to do a far better job of using the capabilities they have in managing students. By the year 2000 I don't think we're going to find classrooms all around the state filled with thirty micros. I can foresee perhaps five to a classroom.

The ability of instructional software to meet the instructional needs of a variety of students will be the critical factor. It is a difficult task to write software that will be serviceable for a wide range of students--slow learners, talented or gifted, ethnic minorities, or others with particular learning skills or weaknesses. Having teachers create their own software may not be the answer.

"I sincerely doubt that having teachers write their own software is a viable alternative," says Jones. "It's not that teachers aren't capable of doing it, it's just that is takes so much time and dedication to do it well. In order to write good software you really have to be in the

business full time. You're either a full time teacher or a full time programmer. Basically I see teachers being educated to take other people's programs and adapt them to their specific circumstances."

It is difficult to predict the eventual impact of microcomputers on education. Only ten years ago micros didn't even exist. Technology may surprise us again. Jones of OTIS reviewed three possible scenarios.

> One was that computers would usher in a new golden age of learning where teachers would be relieved of tedium and would be able to respond to students one on one. Students would be stimulated and challenged by the possibilities inherent in computer based education. The second was the opposite end of the spectrum. Instead, computers would actually increase the alienation of humans from each other. They would increase the dehumanization of mankind. The third view is the one to which part of me subscribes. It is this: schools are massive organizations that are terribly entrenched. The intertia of past systems is overwhelming. Business will go on as usual. There really will not be a major change. It is more likely that computers will enhance education and augment what a teacher can do in the classroom than create a revolution in education.

Jone's interpretation of the impact of microcomputers is in accordance with what many predict. Public education, for many reasons, adopts technology slowly. Major changes in classroom instruction will not be quick to materialize. Nonetheless, microcomputers are already becoming an everyday fact of life in Oregon schools.

Sources of Information

To assist schools in gathering information about microcomputers, the instructional technology office at the State Department of Education is printing a report detailing microcomputer usage in Oregon. The report will include the survey information on the different areas in which micros are used in schools, a catalog of which schools have what kind of computers,

and the names and telephone numbers of computer people at each school to be contacted for further information. Distribution of the report is scheduled for May 1982. Sanner's office will provide information about the report upon request.

Another source of information is Portland's Northwest Regional Educational Laboratory. "We offer technical assistance to the Northwest region," explains Don Holznagel. "We give assistance on hardware selection, software selection, installation, inservice for schools, and planning assistance to fit specifications. If someone wants these services they can contact us and we arrange a contract with them for a certain number of hours or days, or whatever it takes for that kind of assistance."

Presently their Micro Sift project acts as a clearinghouse for information about microcomputer applications in education. Evaluation of both hardware and software is one of its activities. The Northwest Laboratory is building a data base about micros that will eventually permit computer searches in response to requests for specific kinds of information. The computer program they are creating is called Resources in Computer Education (RICE). It is hoped that RICE will be available to schools by fall 1982. Districts will be able to purchase search time in order to look for information about programs by grade level, subject, topic, or any particular they wish. All current data are being fed into a large computer and the files are being tested. The incredible amount of quickly changing information is the main problem at the moment. Keeping up with all the changes will be the challenge.

The Northwest Laboratory is also producing a series of reports aimed at educational decision-makers. These reports will deal with administrative application of micros, computer literacy, and other implications of micros. Reports should be available through the ERIC network or schools can contact Don Holznagel at the Northwest Laboratory for more information.

For More Information

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Interviews

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Ben Jones, department head, Instructional Services Division, Oregon Total Information System, Eugene, Oregon. Telephone interview, March 15, 1982.

Jim Sanner, specialist, instructional technology, Oregon Department of Education, Salem, Oregon. Telephone interview, March 11, 1982.

Keith Snuggerud, teacher, Oakridge High School, Oakridge, Oregon. Interview, February 3, 1982.

Ron Tenison, director of computer science, Catlin-Gable School, Portland, Oregon. Telephone interview, March 11, 1982.

Joan Thormann, doctoral candidate, College of Education, University of Oregon, Eugene, Oregon. Interview, March 10, 1982.